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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in and relating to Heat Exchange Apparatus

We, THE AIR PREHEATER COMPANY, INC., a corporation organized and existing under the laws of the State of Delaware, United States of America, located at 60 East 42nd Street, New York City, State of New York, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statements:—

This invention relates to flexible expansion joints for use in apparatus between independent parts thereof that move relative to one another when subjected to variations in thermal conditions. More particularly this invention relates to heat exchange apparatus wherein a housing member, a bank of heat exchange elements therein, and the necessary connecting ductwork are all held in fluid-tight relationship while they are permitted to move relative to one another when subjected to thermal variations that effect expansion and contraction of the several members.

Expansion joints of the well known bellows type are commonly used where required to accommodate differences in the expansion of the several parts of heat exchange apparatus, expansion joints of this type being used separately and individually wherever required. An arrangement of this type requires that there be a multiplicity of sizes and shapes of the joints and plurality of places where used such that they occupy excessive space, are expensive to install, and difficult to maintain.

Accordingly it is the principal object of this invention to provide a multiple type expansion joint for use between three or more relatively movable members. It is a further object of this invention to provide a housing for heat exchange apparatus utilizing therein one or more multiple expansion joints that effectively preclude leakage of fluid while permitting variations in thermal expansion. Moreover it is still another object of this invention to provide the above-mentioned fluid-tight multiple expansion joint for use in a space usually required for a single expansion joint.

These and other objects of my invention will become more apparent when read in conjunction with the drawing in which:

Figure 1 shows a side elevation of a tube type heat exchanger that employs expansion joints of the type described in the foregoing disclosure.

Figure 2 is an enlarged detail drawing of the arrangement that comprises the invention, and

Figure 3 shows a modified form of the invention, and

Figure 4 is a schematic drawing showing a conventional expansion joint arrangement for apparatus having a plurality of elements movable with respect to one another.

Apparatus of the type defined herein comprises a heat exchanger having a core of tubular units 22 supported at its ends by tube sheets 24 whereby the tubular units may be interposed in a housing structure 25 having spaced inlet and outlet ducts 26 and 28 that direct a first fluid through the tubular units 22. Other inlet and outlet ducts 32 and 34 in the housing direct a second fluid over the tubes in order that heat from one fluid may be readily transmitted through the tube walls to the other fluid.

Inasmuch as the temperature of the several fluids traversing the flow passageways of the heat exchanger may vary greatly, the apparatus enclosing the several fluids may be subjected to considerable expansion and contraction during normal operation. A conventional arrangement frequently utilized to preclude leakage while permitting relative movement between adjacent parts of such apparatus is to simply provide a flexible joint 36 between the relatively moving housing 25 and core 27 in the manner shown in Figure 4 of the drawing.

Inasmuch as additional relative movement obtains between core 27 and duct 26 another expansion joint 38 is positioned between the

heat exchange core and the connecting duct work to permit the heat exchanger and the housing to expand and contract independent of one another. This arrangement extends longitudinally to occupy excessive space and to require the installation of an independent expansion joint for each pair of relatively movable members.

In accordance with the present invention we provide a compact joint arrangement for use between a multiplicity of relatively movable parts such as a tube core, a surrounding housing, and an axially aligned duct means. Our expansion joint arrangement is adapted to permit complete freedom from interference between parts while it effectively precludes fluid flow between the several parts.

An expansion joint according to the invention shown in Figure 2 comprises an essentially thin, flexible, metallic member 42 formed with a substantially U-shaped cross section and having one edge secured at 44 in fluid tight relation to the housing member 25 while the other edge thereof is connected to the core member 27. The core member 27 slidably abuts the housing member 25 while the flexible joint 42 precludes fluid flow therebetween. Inasmuch as relative axial movement similarly occurs between the housing 25 and axially spaced duct 26, a flexible fluid-tight joint 48 is additionally required to preclude fluid flow therebetween The flexible joint 48 is thus arranged concentrically around flexible joint 42 to occupy a minimum of space. The flexible joints 42 and 48 may be press formed from a plurality of parts and joined as by welding along abutting flanges 50 to provide an economical method of manufacture.

A second form of the invention illustrated in Figure 3 comprises an annular flexible member 52 of U shaped cross-section having one end secured at 54 in fluid-tight relation to the housing 25 while its other end is secured at 56 to the movable duct member 26. An essentially annular, plane flexible member 58 lying within the U-shaped member 52 has an outer flanged edge 62 connected thereto and an inner flanged edge 64 connected to the core member 27 or another intermediate movable member.

By this arrangement movement of the housing 25, core member 27 or duct 26 is readily accommodated by flexure of the expansion means connected thereto. Moreover, as any individual portion 52 or 58 of the expansion joint is moved directly by virtue of its being connected to a movable portion of the heat exchanger, it is also moved indirectly when another portion of the expansion joint is forced to conform to movement of that portion of the heat exchanger assembly connected thereto.

Thus any portion of the flexible joint assembly 52, 58 is subject to flexure even though it is not connected directly to that portion of the supporting structure which is being moved as a result of thermal expansion or contraction to thereby distribute such flexure over the entire joint assembly.

It is apparent that apparatus of this type may be further modified to permit relative expansion and contraction between more than three independent members, and it is accordingly intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

WHAT WE CLAIM IS:—

1. A heat exchange apparatus having a multiplicity of axially spaced parts that expand and contract independently in response to changing thermal conditions, including means that preclude fluid leakage between said parts while permitting relative movement therebetween comprising a first flexible sealing member secured in fluid tight relationship with a pair of independent and relatively movable parts of the heat exchanger and a second flexible sealing member substantially concentric with said first sealing member and secured in fluid tight relationship to one of said parts and to another movable and separate part of the heat exchanger.

2. Apparatus as claimed in claim 1, wherein said pair of parts comprises respectively a core unit of heat exchange members and a surrounding housing, said parts lying in spaced relation with duct means that direct the flow of fluid to and from said core, said duct means constituting said other movable and separate part of the heat exchanger.

3. Apparatus as claimed in claim 2, wherein said exchange members include a bank of tubular members.

4. Apparatus as claimed in any one of the claims 1 to 3, wherein said second sealing member surrounds the said first sealing member.

5. A heat exchange apparatus substantially as herein described with reference to Figures 1 and 2 of the accompanying drawings.

6. A heat exchange apparatus substantially as herein described with reference to Figure 3 of the accompanying drawings.

MARKS & CLERK,
Chartered Patent Agents,
Agents for the Applicants.

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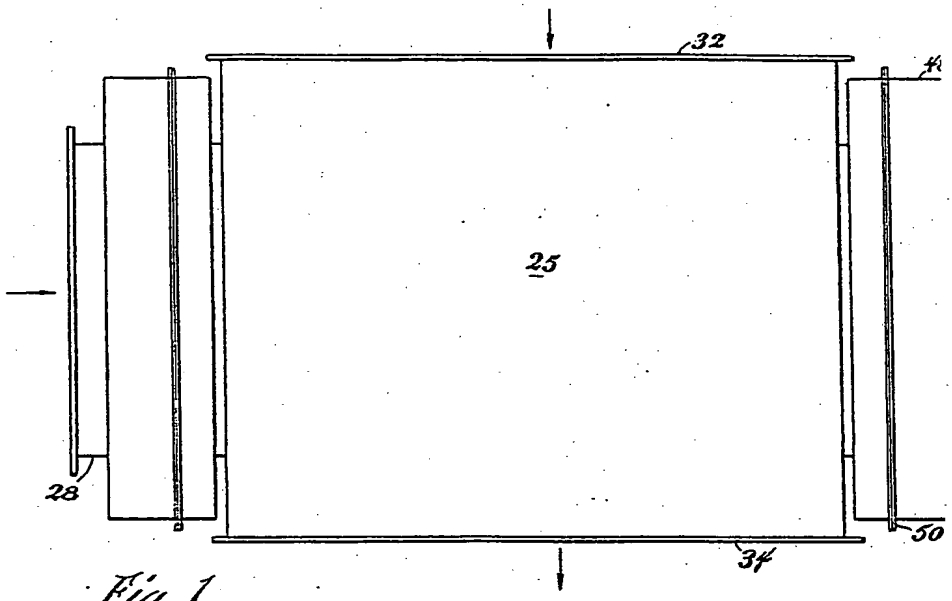

Fig. 1

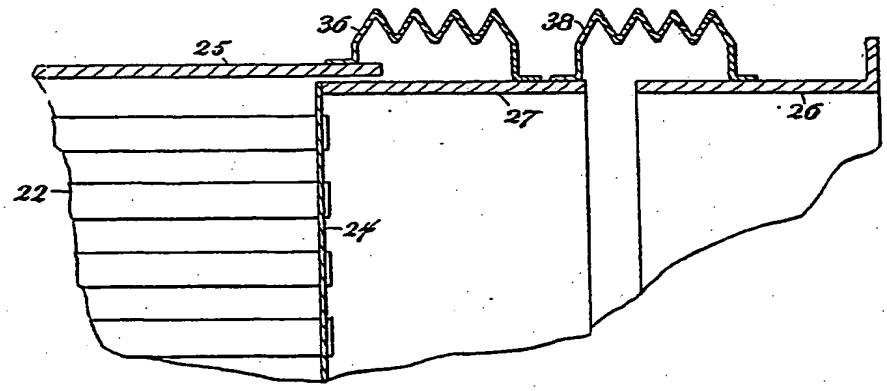

Fig. 4

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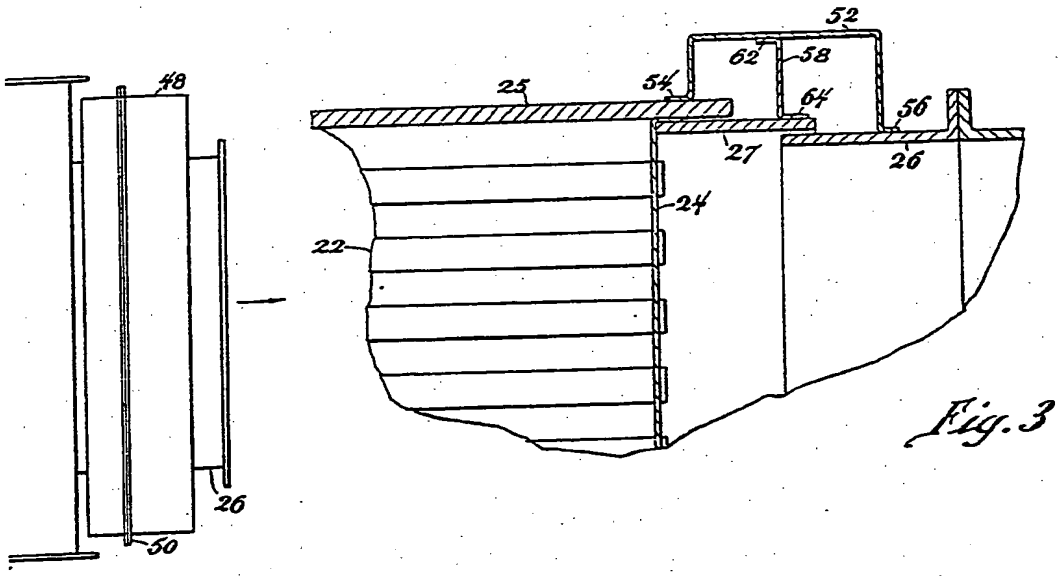

Fig. 3

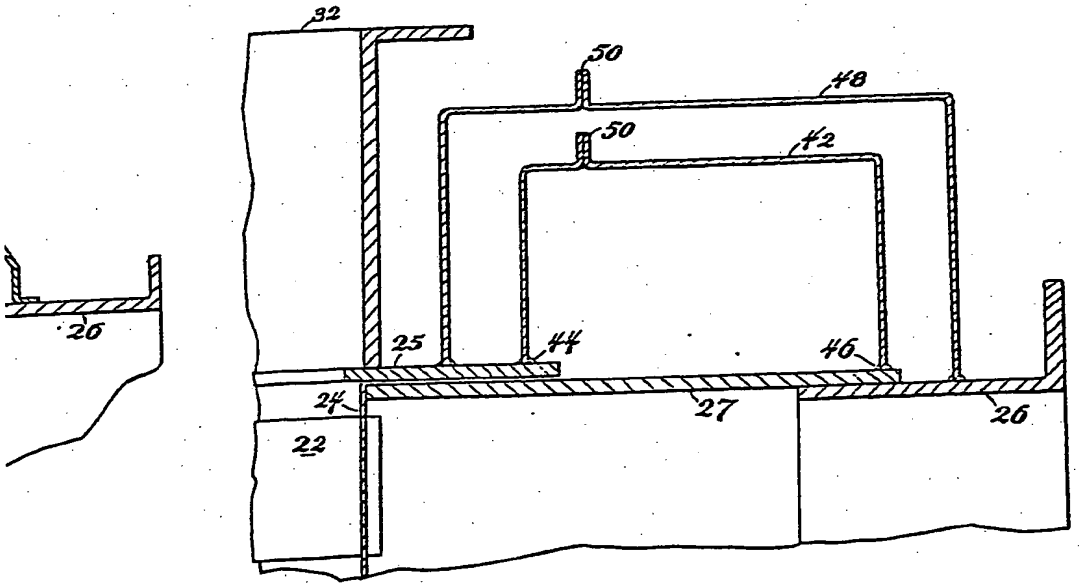

Fig. 2

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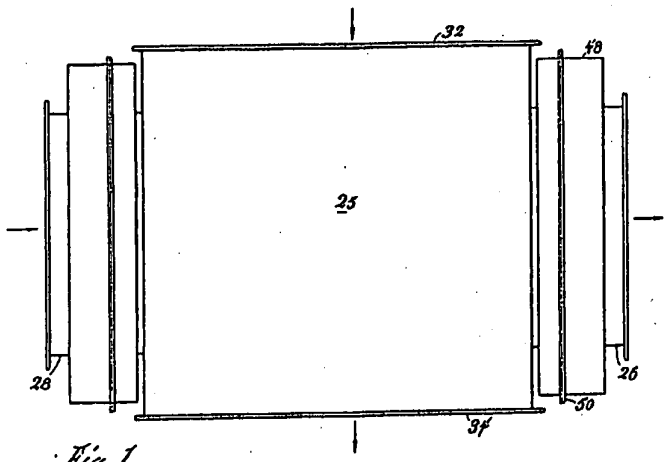

Fig. 1

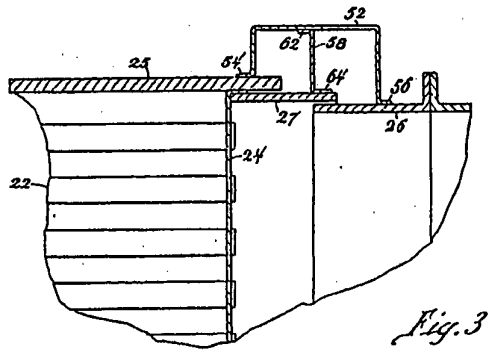

Fig. 3

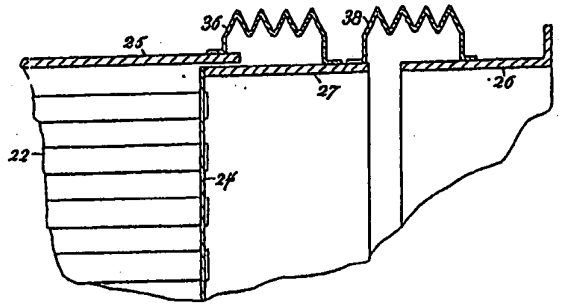

Fig. 4

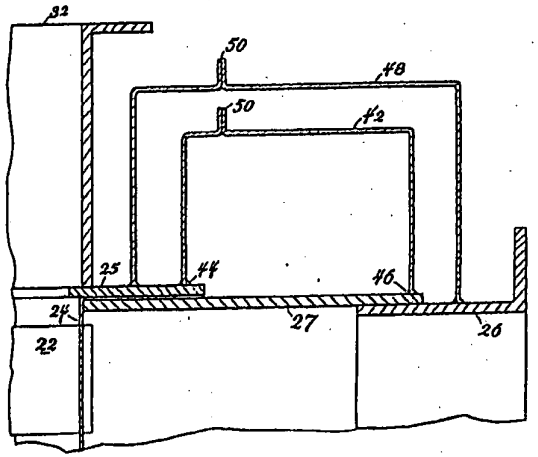

Fig. 2